STATE OF THE GREAT LAKES 2012

Michigan Office of the Great Lakes

Department of Environmental Quality

PURE MICHIGAN

Contents

DNR Photo: David Kenyon

Introduction

Governor Rick Snyder

Michigan is defined by the waters that surround us.

Of course the Great Lakes define our geography. But they also play a defining role in our recreation, our economy, even our weather. Our waters shaped our history, and they will shape our future. We must keep a strong focus on protecting and managing the Great Lakes because they are an integral part of our quality of life. Beyond the deep personal and cultural connection most Michiganders feel to the lakes, they are a key reason people come here to live, work and play.

The State of the Great Lakes report is an annual publication for Michigan residents and the state legislature about what is happening in the Great Lakes. The following pages document everything from the historic update of a bi-national agreement protecting water quality to updates on impacts of invasive species, snapshots of wetland protection efforts and some bright news about restoration efforts along Michigan's coastline.

The state of the Great Lakes is steadily improving by many measures. The first bill I signed as Governor of Michigan codified a farming program aimed at reducing agriculture's impacts on Michigan waters. The state has done a lot to reduce phosphorus in our waters, a leading cause of harmful algae blooms. We are making steady progress to improve beach monitoring, ensuring that visitors who come to enjoy a day at the beach can do so with confidence in the water quality.

But we still have much work to do. The Council of Great Lakes Governors late this year elected me to co-chair the group, and I am honored to accept the nomination. It is an opportunity to bring Michigan's voice to the head of the table on some very important issues for which interstate collaboration could be the key to success.

My special message on energy and the environment this year identified some key concerns—aquatic invasive species are an environmental threat we must address more effectively, and Michigan will continue to be a leader. I also have called on the Department of Environmental Quality to produce a comprehensive water strategy for water quality and use throughout the state. I have asked for stronger focus on green solutions to improve our storm water management, more funding to improve municipal sewer systems and a comprehensive reinvention of our wetlands management program.

We reside in the middle of one-fifth of the Earth's surface freshwater. I am proud of the leadership Michigan has historically shown on issues affecting the Great Lakes, and I hope you share with me the commitment to continue that tradition as a legacy for our children and their children.

Our wetlands, lakes, rivers and streams are all connected to the Great Lakes, and we must consider that interconnection as we look for ways to protect and manage them. Similarly, our communities, businesses, tourism economy and our individual quality of life in Michigan is inevitably connected to the Great Lakes, so our stewardship must reflect our dependence on the waters that define us.

DNR Photo: David Kenyon

On the Sustainability of Systems

Jon W. Allan
Director, Michigan Office of the Great Lakes

In ecology, sustainability usually refers to an ecosystem's ability to persist as a whole over time. This equation also typically considers economics and social influences. But it rarely includes the human experience—things like engagement and citizenship, affinity to each other and to our love of place.

I believe these elements are absolutely and deeply interrelated, and that our healthy natural systems form the foundation of this relationship. The more resilient and biologically intact a coastal ecosystem remains, the more social and economic benefits it can provide. We have too often forgotten this bond, and historically chose to sacrifice long-term system integrity and health for short-term excess.

With the firm goal in mind of expanding and strengthening our social, ecological and economic linkages, I keep an eye squarely fixed on the hallmarks of healthy natural systems. For me, they come down to four basic principles:

- Bolstering resilience—the ability to respond to change and system stress
- Maintaining a broad diversity of plants and animals
- Preserving distinctive natural systems
- Fostering "intactness" of our landscape

The last idea may be new to some. It means that systems function better as large continuous expanses than small, disconnected stretches. For example, our groundwater flows into and feeds our streams, lakes and ultimately the Great Lakes. These linkages and the maintenance of hydraulic flow is an important piece of a healthy and intact landscape.

The Michigan Department of Environmental Quality's Office of the Great Lakes shepherds the maintenance of existing habitat and function, guarding the environment from threats such as aquatic invasive species or overuse of resources, and pursues the restoration of degraded environments.

Simultaneously, the office facilitates appropriate use and enjoyment of these resources—the fish, wildlife, minerals, air and water. Finding the balance can be difficult at times, but that balance is informed by learning about what sustains the processes that supply us these materials and goods from nature, and managing our wastes with care.

DNR Photo: David Kenyon

I suggest that a next logical step in this progression involves placemaking and shared governance. This idea builds on healthy ecosystems, champions forward-looking planning, design and management of public spaces, and supports people in strengthening their connections with and love of their communities and regions.

But behind the scenes of placemaking, people also must be able to rely on water as a resource in their everyday lives, and that requires adaptable infrastructure. Because healthy, resilient systems naturally vary over time, we should design and build to prepare for these changes. For example, lower lake levels in the Michigan-Huron system have affected commercial navigation and recreational boating. The situation presents significant and costly implications for water use.

We should look at smart options such as creating more green infrastructure in our cites and along the coasts. This, in turn, creates open space like parks and rain gardens, which fuels placemaking.

In designing infrastructure, we must consider its interactions with aquatic invasive species such as zebra and quagga mussels. Their prodigious reproduction can clog water intakes costing millions. Likewise, we can scarcely imagine the consequences of Asian carp overrunning the Great Lakes. Once foreign organisms become established, they are nearly impossible to eradicate—and they can disrupt food webs and wreak ecological, economic and social havoc.

More thoughtful and protective infrastructure, a vigilant defense of the lakes' biological systems and ecological processes, and careful diligence in fostering and expanding the human use and enjoyment of this great resource will fortify our relationship with our waters and reinforce our identity as the Great Lakes State. Michigan's Governor calls for these integrated solutions in his Specical Message on Energy and the Environment. For example, creating sense of place by celebrating the waterfront as a gathering site will add to that improved quality of life.

Our system is sustainable if and only if it persists as a healthy whole over time—economically, socially and ecologically. It is sustainable if and when we turn to our Great Lakes and see ourselves reflected back in our waters and in our places. This sustainability requires a dogged pursuit of citizenship, engagement, common vision and and a very real love of the places we call home.

DNR Photo: David Kenyon

Chapter I: Water Quality

The largest freshwater system in the world has drawn people to Michigan and the Great Lakes region for centuries. Even with frequent global shortages, the basin will continue to provide us abundant fresh water—as long as wise management of Great Lakes water quality remains a priority for Michigan and the other Great Lakes states and provinces.

This stewardship responsibility was recognized in 1909, when the Boundary Waters Treaty was first signed by the United States and Canada. Through the treaty, the International Joint Commission was established to oversee boundary waters, including the Great Lakes, and to deal with serious problems threatening these resources. This year, for the first time in 25 years, the U.S. and Canadian governments met after several years of negotiations to codify updates to the agreement's provisions for restoring and protecting the Great Lakes. The amended binational agreement addresses today's issues in the lakes and creates a structure for measuring progress toward our goals, including maintaining and improving water quality in the basin.

With careful stewardship, wise management and sustainable practices, these precious freshwater resources will be available for generations to come. The Great Lakes provide for more than 40 million people who reside within the basin. The lakes also support recreational opportunities, cool the heat of industry, offer diverse fisheries, supply irrigation to agriculture, and help power our homes and businesses.

But water quality has suffered due to human use and overuse during the past century. Michigan places high priority on water quality and the state has a number of programs in place to manage what gets into our waterways, monitor and detect problem substances and clean up contamination if and when it is found.

The Michigan Department of Environmental Quality's Water Resources Division has established metrics to measure progress in meeting standards for water quality in the state. These measure beach bacteria levels, chemical uptake in fish and nutrients that contribute to algae growth. With this information, the state can monitor the effect of management practices and regulations, and modify them as needed to best protect and improve Michigan's water quality.

Other efforts are underway to address nutrient runoff, sedimentation and pollution. The Michigan Department of Agriculture and Rural Development administers the Michigan Agriculture Environmental Assurance Program, an incentive-based, voluntary program that helps farms prevent or minimize agricultural pollution risks.

The Great Lakes are far more than a mere geographical feature. The quality of their abundant fresh water is central to our lives and our lifestyle. Michigan works daily to preserve and improve our waters so the basin can flourish ecologically, economically and socially.

Great Lakes Water Quality Agreement: An Updated Clean Water Constitution

Rick Hobrla
Chief, Areas of Concern and Great Lakes Coordination programs
Michigan Office of the Great Lakes

On September 7, 2012, at the Canadian Embassy in Washington, D.C., U.S. Environmental Protection Agency Administrator Lisa Jackson and Canada's Minister of the Environment, Peter Kent, signed the newly amended Great Lakes Water Quality Agreement. First signed in 1972 and last amended in 1987, the GLWQA is a model of binational cooperation. Its purpose is to protect the chemical, physical and biological integrity of the world's largest surface freshwater system. The signing ceremony marked the culmination of three years of public hearings and binational negotiations.

The revised agreement will facilitate government action on threats to Great Lakes water quality and includes strengthened measures to anticipate and prevent ecological harm. New provisions address aquatic invasive species, habitat degradation and the effects of climate change. Annex Committees will be established in the coming months to advise the Parties on how to implement these new provisions.

The agreement adopts some basic principles and methods including adaptive management, a precautionary approach and science-based management. The adaptive management concept suggests that solutions must first be tested, then modified as necessary to achieve desired results. The precautionary principle states that lack of full scientific certainty should not be used as reason for postponing measures to prevent environmental degradation. Science-based management means that decisions should be based on the best available science, research and knowledge.

Another significant change in the revised GLWQA is the addition of notification and response requirements. In the event of a pollution incident or the threat of one, the federal governments are committed to sharing information across borders. If planned activities could lead to a pollution incident or have a significant cumulative impact on the Great Lakes, the federal governments will provide notification to one another. Examples include the storage and transfer of nuclear wastes, the construction of oil and gas pipelines and the establishment of new mines, refineries or power plants.

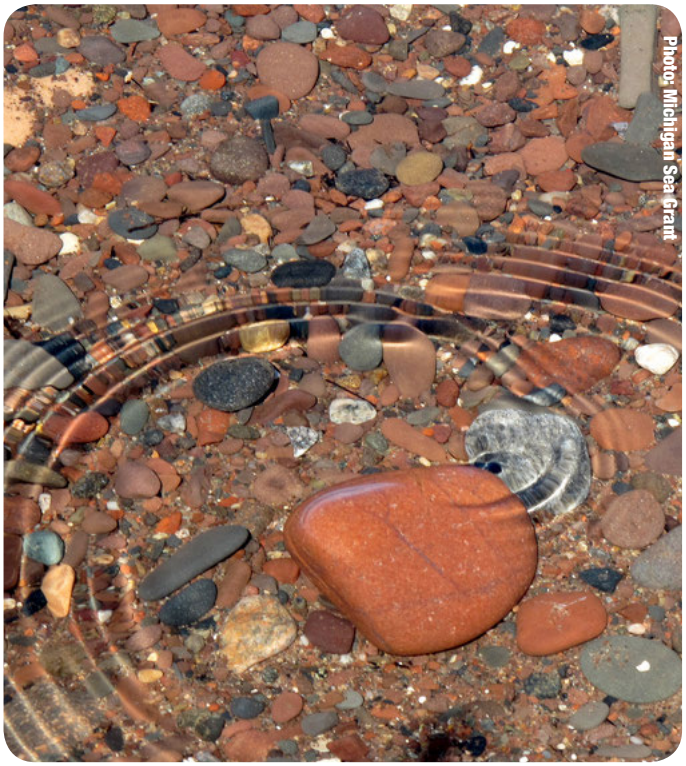


Photo: Michigan Sea Grant

The agreement expands the role of the International Joint Commission, a binational advisory board formed under the Boundary Waters Treaty to advise the U.S. and Canadian governments on cross-boundary water issues. The IJC is charged with preparing a triennial assessment of progress toward the goals of the GLWQA. In conjunction with this report, the Parties will convene a triennial Great Lake Public Forum to solicit input on the state of the lakes and binational priorities.

While introducing important new adjustments, the new agreement also preserves important parts of the 1987 language. It retains the phosphorus loading goals for each of the lakes while adding other phosphorus concentration goals. It retains the requirement to establish and implement Lakewide Action and Management Plans for each of the Great Lakes. Finally, it continues the Area of Concern program, which identifies geographic areas of degradation, and requires the development of Remedial Action Plans to restore them.

The amended agreement sets out a shared vision for a healthy and prosperous ecosystem, in which the waters of the Great Lakes enhance the livelihoods of present and future generations of Americans and Canadians. While the agreement is between the federal governments of the United States and Canada, it recognizes that "the involvement and participation of State and Provincial Governments… are essential to achieve the objectives of this Agreement." Michigan, the Great Lakes State, will continue to play a key role in protecting and restoring this prized, shared resource under the revised agreement.

Measuring Success in the Great Lakes: A Water Resources Perspective

Dawn Roush
Aquatic Biology Specialist
Michigan Department of Environmental Quality

A recent Pure Michigan commercial pays tribute to our water resources: clean lakes, clear streams and more freshwater coastline than any other state in the country. That message also reflects the goals of the Michigan Department of Environmental Quality; making our waters safe and clean for recreation, fishing, drinking and healthy aquatic ecosystems.

In the past two years, the DEQ set out to measure progress toward our goals and better explain what we do well and what could use improvement. We call these metrics our "Measures of Success," and refines our mission to achieve meaningful outcomes. Our mission has not changed, but by setting goals and measuring our progress, we can better examine the big picture for water quality and quantity, and place our work within that broader context.


DNR Photo: David Kenyon

We have worked for decades to improve water quality through programs that eliminate beach closings, reduce contaminants in fish tissue and decrease nutrient loads to our Great Lakes. The Measures of Success help us communicate with the broader public how that work is proceeding.

For example, the DEQ is tallying the 2012 beach monitoring data reported in BeachGuard, a public online resource that provides water quality data, beach advisories and closures. We monitor 430 of more than 1,200 public beaches in Michigan to determine whether beaches are safe for swimming. BeachGuard shows that 105 beaches (24 percent of the monitored beaches or 8 percent of all beaches) reported advisories or closures on at least one day in 2012.


DNR Photo: David Kenyon

Our goal is that all of our beaches will always be open, with waters safe for swimming. We are working toward this with local partners to leverage resources and eliminate known pollution sources such as illicit wastewater connections and nonpoint source runoff. Negative impacts of these sources of pollution such as elevated *E.coli* levels at beaches can be exacerbated during wet weather events.

The DEQ contributes to the state's annual fish advisory, which informs the public about which species are safe to eat by coordinating fish collections and contaminant analyses. There has been a statewide fish consumption advisory for mercury since 1988. The goal is to reduce mercury, as well as PCBs and dioxin, to levels that are safe for consumption in the fish of our Great Lakes, inland lakes and rivers.

Through our Measures of Success, we have tracked reductions in mercury from wastewater facility discharges. Despite this reduction, there has been essentially no corresponding decline in mercury levels in edible portions of fish to date. This is due to the significant atmospheric deposition loading from other sources, such as coal-fired power plants.

This tracking has shown that to reach our fish consumption goal, the DEQ will need to focus primarily on reducing atmospheric deposition. Currently, Michigan's Statewide Mercury Strategy aims to reduce all of these sources, and our Measures of Success will continue to track our progress.

The Measures of Success also establish goals for nutrients in our waterways. The highest phosphorus concentrations in Lake Huron are in Saginaw Bay, where efforts have been underway since the 1970s to address related concerns. Although the goal of 15 micrograms per liter of phosphorus has finally been achieved in Saginaw Bay, nuisance conditions like beach muck have continued. This has led the DEQ and its partners to examine the influence of invasive species such as zebra and quagga mussels, changing water levels and other factors that may complicate solutions to nutrient-related problems.

Tracking progress on water quality improvement efforts provides critical guidance for new strategies. We are dedicated to maintaining clean water resources for the use and enjoyment of residents and visitors, now and in the future.

For more information on the Water Resources Division and a closer look at the Measures of Success, please visit our website at www.michigan.gov/wrd.

Michigan Farmer Verification Program Encourages Stewardship

Jan Wilford
Program Manager, Michigan Agriculture Environmental Assurance Program
Michigan Department of Agriculture and Rural Development

Through programs like the Michigan Agriculture Environmental Assurance Program, Michigan's agricultural community plays a key role in stewarding our natural resources. MAEAP helps farms of all sizes and means voluntarily prevent or minimize agricultural pollution risks. The program aims to reduce farmers' legal and environmental risks through education, the completion of a farm-specific risk assessment and an on-site verification that farmers have implemented recommended practices to protect water quality.

MAEAP began not as a government or regulatory program, but rather a partnership effort designed to protect natural resources and advance positive community and neighbor relations. This collaborative partnership links the Michigan Department of Agriculture and Rural Development, the Michigan Environmental Assurance Advisory Council and the agricultural and environmental communities together toward a shared goal of improving and protecting water quality.

> **"Michigan is leading the way nationwide in effective stewardship practices with the voluntary, incentive-based MAEAP program. This continued effort shows agricultural producers long-term commitment to protecting the environment while maintaining economic success."**
>
> **-MDARD Director Jamie Clover Adams**

Program Emphasizes Collaboration and Cooperation

MAEAP was first developed in 1997 by a coalition of farmers, commodity groups, state and federal agencies, universities, and conservation and environmental groups. This collaboration provides a forum for farmers to become better educated about management options that could help protect natural resources. Further, MAEAP provides assistance to make needed changes to farm practices and verify that appropriate practices were embraced by all partners and are actually being implemented. Representatives from these groups are still involved in MAEAP's work, serving on committees and spreading the word to encourage farmers to participate. In 2011, Public Acts 1 and 2 codified MAEAP into law, providing incentives and an official structure for the program.

Photo: MAEAP

To become MAEAP verified, farmers must complete three comprehensive steps:

1. Attend an educational seminar
2. Conduct a thorough, confidential on-farm risk assessment with a tailored action plan addressing potential environmental risks
3. Complete an MDARD site inspection

Each of MAEAP's systems—Livestock, Farmstead and Cropping—examines a different aspect of a farm, as each has a different environmental impact.

Once the farmer completes the first two steps, a MDARD staff member inspects the farm. This verifies that the farm meets MAEAP program requirements related to applicable state and federal environmental regulations and Michigan Right to Farm guidelines, and that the farmer adheres to MAEAP standards. When successfully completed, the producer receives a certificate of environmental assurance and may display a MAEAP sign signifying that the farm is environmentally verified. To remain a MAEAP-verified farm, MDARD inspections must be conducted every three years and farm operators must meet MAEAP standards.

MAEAP Continues to Grow

Every year, Michigan farmers attend educational programs geared toward environmental stewardship and MAEAP verification. More than 10,000 Michigan farms have started the verification process, with almost 1,400 verifications to date. Annually, more than $1.2 million is invested for best management practice implementation by farmers working toward MAEAP verification. MDARD estimates that MAEAP helps to reduce the phosphorus loads reaching streams by more than 340,450 pounds annually.

For more information, contact Jan Wilford, MAEAP Program Manager, MDARD, at 517-241-4730, wilfordJ9@michigan.gov, or visit www.maeap.org.


DNR Photo: David Kenyon

Chapter II: Water Use
Stewardship of a Shared Resource

Jon Allan
Director
Michigan Office of the Great Lakes

The Great Lakes are a shared resource. Their currents could deliver a message in a bottle from Michigan to any of seven other states or even Canadian shores. This multiplicity of jurisdictions represents the third most populous coastal region in the U.S., with 10 percent of Americans and more than 30 percent of Canadians living and working in the basin. And because this is such a broad swath of people, with a rich biological, commercial and recreational dependence on water, we all must work together to use the resource with the utmost care.

Today, people on the shores of the Lake Michigan-Lake Huron system are facing the possibility of all-time low water levels. Some believe that diversions taking water from the lake system at the Chicago Sanitary and Ship Canal and increased flow on the St. Clair River has exacerbated these reductions, and that undoing these human changes will raise lake levels.

Practically speaking, only nature can raise these lake levels, but humans historically have had an impact. The St. Clair River channel was expanded in the 1960s, increasing its outflow and lowering lake levels by 10-16 inches. Some have suggested that installing weirs in this location could raise the water but this would have little effect, high costs and would impede shipping.

The Chicago Sanitary and Ship Canal, completed in 1900, ultimately lowered the lakes' levels by about two inches. Incidentally, man-made diversions into the system near Thunder Bay, Ontario, raise the water more than that amount.

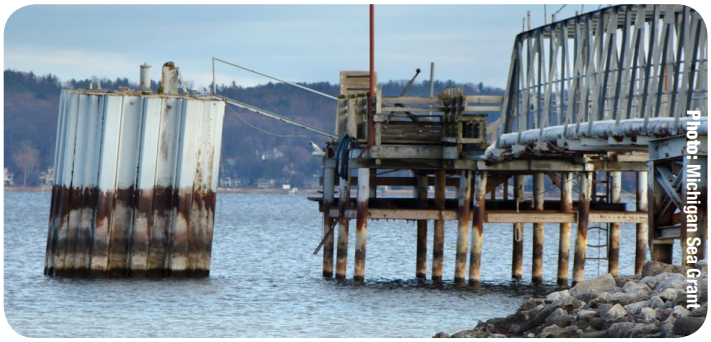


Photo: Michigan Sea Grant

While we all are at the mercy of nature on this issue, it provides a salient example of how water use can affect people all around a lake. Back at the turn of the century, the Sanitary District of Chicago did not consult with Canada about constructing its diversion, and by 1907 the two were embroiled in litigation over lake levels and navigation.

Today we have a monumental, game-changing tool to avoid water use conflicts. The Great Lakes Compact provides a framework for consensus-based decision-making about how water from the lakes can be used, in what quantities and where. For any diversion, the state receiving that water must make a case to the other states and provinces in the compact that the removal of that water will meet the requirements set forth in the agreement.

Another tool unique to Michigan is the Water Withdrawal Assessment Tool. With this online interface, the resource impacts of a proposed withdrawal can be predicted in advance. According to state law, any withdrawal must meet the environmental and ecological standard of "no adverse resource impact" before it can begin. One critical aspect of the tool is that it continually adjusts to account for new withdrawals and uses science-based metrics.

Within the state, the southwest region has experienced prevalent large quantity withdrawals. To address this issue, the legislature convened the Southwest Michigan Water Resources Council in 2011 to evaluate existing tools and processes in the St. Joseph and Kalamazoo River watersheds, as well as recommend a new state water conservation and efficiency program. Their study is currently underway and will inform future improvements to managing these uses.

The Great Lakes states and provinces have a responsibility to each other to continue to find ways to improve the efficiency and wisdom with which we use this freshwater treasure. We must take advantage of innovative technologies to encourage greater stewardship of our water resources so they may support healthy natural systems and human use and enjoyment forever.


Photo: Michigan Sea Grant

Chapter III: Aquatic Invasive Species

Imagine the Great Lakes without any invasive species. No sea lamprey killing whitefish, no zebra mussels clogging water intakes, no invasive *Phragmites* blocking views and no round goby taking the place of trophy perch on fishing lines. What an incredible, positive difference it would have made in our enjoyment and use of the Great Lakes, as well as in our pocketbooks, to have excluded these interlopers from the start.

But today we find ourselves with well-established invasive species populations—and without an inexpensive control method for any of them. In fact, most have no effective control method at all.

Pondering the bygone benefits and present costs of invasive species provides a powerful incentive to prevent more intrusions from non-native plants and animals. Michigan needs capacity to take decisive action in response to any new species that may be discovered. Whether one fishes, boats, swims, drinks treated water, enjoys the views from the shore or all of the above, invasive species have diminished everyone's use and enjoyment of the Great Lakes.

Several state, federal and local governments as well as many non-governmental organizations directly target prevention—the most cost-effective tool available. Many species are poised to enter the Great Lakes, if we provide them with—or fail to block—a pathway to get here. Michigan has a number of strategic efforts underway to close these pathways and reduce the spread of the species already here.

The threat of Asian carp has aroused an unprecedented public engagement and understanding of a complex issue. The region is fortunate to have strong support for deterrence which, combined with federal Great Lakes Restoration Initiative funding, has led to a flurry of projects to address the issue.

Increased prevention, control and response capacity have been established at the federal, state and local levels of government as well as in non-governmental organizations and universities. A January 2012 report, "Restoring the Natural Divide," outlined strategies to best minimize the risk of AIS from the Mississippi River (http://www.glc.org/caws).

Michigan has formed a collaborative team consisting of the Departments of Environmental Quality, Natural Resources, Agriculture and Rural Development and Transportation to create and implement a new state management plan for invasive species. The Wildlife Division in the Department of Natural Resources administers a GLRI grant to create capacity for rapid response to any new species discovered in the state.

While connected waterways present the most intuitive pathway for invasive species, 2012 has been a critical year for further action on controlling another vector—ships' ballast water. The U.S. Environmental Protection Agency and U.S. Coast Guard have finalized standards for ballast water treatment, which will further reduce the risk of new species arriving in the Great Lakes.

The news is not all good, however. Invasive *Phragmites*—a grass that can devastate coastal ecosystems—has proven exceedingly difficult to contain. At great expense, thousands of our inland lakes receive chemical treatment every year for other invasive plant growth. In addition, commercial trade of organisms, including Internet sales, has emerged as an open pathway for many non-native species to arrive in Michigan.

Regardless of one's use of the lakes, the responsibility to ensure the exclusion of non-native species and containment of those already here falls to each one of us. Whether at the helm of a 10-foot dinghy or 1,000-foot barge, every captain must ensure his or her vessel is not carrying invasive species—on the inside or outside. Whether a person is on the water every day, once a year, commercial or recreational, his or her gear must be clean. Whether one keeps a small water garden, acres of ponds or just an aquarium, it is his or her responsibility to avoid any invasive plant or animal species.

It is possible to prevent new non-native species from establishing populations in the Great Lakes, but it will require effective, permanent action from all of us.

Asian Carp: Prevention, Detection and the Role of Citizens

Tammy Newcomb
Research Program Manager
Michigan Department of Natural Resources

While no breeding populations of bighead or silver carp, also known collectively as "Asian carp" or "bigheaded carp," have been found in the Great Lakes, they are close enough to warrant the label of an imminent threat. A recent binational risk assessment by Canada, the U.S. and the Great Lakes Fishery Commission concluded that the Chicago Area Waterway System poses the greatest risk for introduction into the Great Lakes.

The report noted that as few as 10 males and 10 females in the Great Lakes could provide a reproducing population. Experts predict that these voracious fish would thrive in the system's rivermouth bays, Saginaw Bay and Lake Erie. But the Michigan Departments of Natural Resources and Environmental Quality, and the Office of the Great Lakes are working diligently to prevent bigheaded carp from entering the Great Lakes in the first place.

Bigheaded and silver carp populations have expanded rapidly up the Mississippi, Missouri and Illinois rivers, and continue to colonize other waterways in new locations. These are long-lived fish that reproduce prolifically and can become huge, sometimes nearing 100 pounds. Bigheaded carp are filter feeders, straining plankton out of the water column, which competes directly with nearly all native species. In addition, due to their size, bigheaded carp consume a great volume of plankton, leaving very little for native creatures.


Photo: Michigan Sea Grant

Because of their feeding habits, carp are not a viable recreational species, but commercial fishing has been used in efforts to control them in places where they are already present. A series of three electric barriers in the CAWS is the last line of defense between the current population front and the Great Lakes.

Now, work is underway to expand on that safety measure. Michigan representatives are delivering our state's message by serving on the Asian Carp Regional Coordinating Committee, an advisory body that oversees activities in the CAWS. Likewise, the state has a voice on the Executive Steering Committee for the Great Lakes Mississippi River InterBasin Study conducted by the Army Corps of Engineers to look into alternatives for preventing invasive species entry to the Great Lakes.


Photo: Dan O'Keefe, Michigan Sea Grant

Through the DEQ's aquatic invasive species program, funds were made available to increase DNR law enforcement efforts to stop the movement of live silver and bighead carp. In addition, the funding will facilitate planning and preparedness should bigheaded carp be found in Michigan's waters. The state's DNR-implemented plan for management of Asian carp calls for prevention, communication, assessment, control, and management (http://1.usa.gov/Tc9TFy).

Separation of the Mississippi River and Great Lakes Basins provides the most viable long-term, sustainable solution to prevent bigheaded carp and other invasive species from disrupting this important resource. A recent study sponsored by the Great Lakes Commission developed a plan to restore the natural basin divide through changes in water/sewage management and control infrastructure, updates in shipping and transportation modes, and placement of barriers. The preferred alternative would cost $3.3 - $4.3 billion, which translates to only $4 peryear for 50 years per household in the two basins.

Michigan citizens must be vigilant and help in the prevention to keep bigheaded carp out of Michigan. Report unusual fish and know your bait species. Materials are available to assist in identification, and an online reporting system is available on the DNR website. Any suspected importation or sale of live Asian carp can be reported to the RAP hotline at 800-292-7800. Michigan's experiences with zebra/quagga mussels, round gobies and sea lamprey prove that prevention is far more effective and less costly than trying to manage invasive species already in the Great Lakes.

Michigan's Comprehensive and Collaborative Attack on Aquatic Invasive Species

Sarah LeSage
Aquatic Invasive Species Program Coordinator
Michigan Department of Environmental Quality

The prevention, management and control of aquatic invasive species can only be accomplished through the coordinated efforts of an extremely large and diverse group of stakeholders. Planning, communication and coordination are essential for success in our efforts to address harmful species already present and potential new invaders.

Michigan's first Aquatic Nuisance Species State Management Plan was approved in 1996. This plan, now called the AIS State Management Plan, is undergoing its second revision with anticipated completion in 2013. The departments of Environmental Quality, Natural Resources, Agriculture and Rural Development, and Transportation collaborated on drafting a complete update of the plan, with feedback from partners.

The draft revised AIS plan outlines new actions for implementation in addition to maintaining and enhancing existing efforts to protect all Michigan waters including the Great Lakes, connecting channels, rivers and streams, inland lakes and wetlands.

The draft AIS plan is based on four goals:

- Prevent new introductions of AIS into Michigan waters
- Limit the dispersal of established populations of AIS throughout Michigan waters
- Develop a statewide interagency early detection and rapid response program to address new AIS
- Manage and control AIS to minimize the harmful ecological, economic, social, and public health impacts resulting from established populations

Photo: Michigan Sea Grant

The draft plan focuses on strategic actions that include development of protective regulations that are consistent across the Great Lakes region, the creation of a comprehensive education and outreach program, and research of new techniques to manage established populations of invasive species. All types of aquatic invasive organisms, from plants to animals and diseases, are covered in the plan.

The plan identifies three priority pathways for which prevention efforts are most needed:

- Canals and waterways, specifically Asian carp through the Chicago Area Waterway System
- Ballast water discharges
- Trade of live organisms

The draft plan also recognizes the need for new efforts to detect and respond to new invaders. The Department of Natural Resources Wildlife Division, in partnership with the Michigan Natural Features Inventory, currently leads a pilot project to monitor and treat populations of several aquatic invasive plants with limited distribution in Michigan. The lessons learned from this project will help further develop Michigan's monitoring program with expanded and coordinated efforts to detect and report AIS using existing field staff and all available external partners.

Species new to Michigan waters can be detected using traditional monitoring techniques such as netting, electrofishing, plant surveys or newer methods like environmental DNA (eDNA) analysis.

Photo: Michigan Sea Grant

This technique tests water samples for trace amounts of genetic material from mucus, scales or other fish parts. eDNA monitoring is underway in strategic locations to look for signs of Asian carp. Researchers are working to expand the use of eDNA monitoring to detect other species of concern not yet known to be in Michigan waters, including snakeheads, *Hydrilla* and golden mussels. Portable testing units capable of quicker sample analysis are being developed to make the testing process more accessible and user friendly.

Several agencies are increasing outreach efforts to build awareness of how to prevent AIS and identify potential invaders. Look for billboards along key highways and posters at local bait shops.

To prevent the next zebra mussel it is critical that we develop a network of professional biologists, educated riparian landowners, boaters and anglers on the water who know what to look for and what to do if they find an unusual plant or animal.

We have accomplished and learned a great deal since Michigan's first plan was finalized more than 15 years ago. We are building on existing AIS prevention, monitoring and control efforts, and moving forward with implementation of the updated plan. Knowing the importance of managing existing AIS while preventing new invaders, our state is "all-in" on this critical issue. Michigan will lead the basin's states and provinces in an unprecedented collaboration to protect our essential Great Lakes resources.

For the updated draft AIS State Management Plan visit www.michigan.gov/aquaticinvasives.

Confronting Aquatic Invasive Species at Isle Royale National Park

Phyllis Green
Superintendent
Isle Royale National Park

Problematic invasive species significantly threaten the ecological, economic, cultural and physical well-being of the Great Lakes ecosystem. The National Park Service protects native species on park lands and waters, and prevention and eradication of invasives at places like Isle Royale National Park is a high priority. Lake Superior and Isle Royale are unparalleled examples of healthy biological systems in the Great Lakes region. Yet aquatic invasive species could unravel these ecosystems. We have seen such impacts with existing aquatic invasive species. Zebra and quagga mussels are among the most damaging and invasive of more than 180 AIS found in the Great Lakes to date. These non-native mollusks have been shown to cause significant damage to local and broad-scale ecological processes and have been especially damaging to native mussel populations.

Zebra mussels, like most invasive species, are highly adaptable. It was once believed that water temperatures, calcium concentrations and even bottom composition would prevent the spread of this nuisance species. However, numerous populations have established themselves in bays and harbors in Lake Superior. In 2009, adult zebra mussels were found at Isle Royale. Where these individuals came from and how long they had been there is unknown. Their rapid and complete eradication at this time is of paramount importance. Otherwise, they may spread across the island and into inland lakes that support some of the highest concentrations of native mussel populations in the Great Lakes.

quagga mussel

Photo: Michigan Sea Grant

National Park divers are actively eradicating the mussels from Isle Royale by manual removal before they can become an established breeding colony. Divers have effectively cleared or reduced populations at popular docks. Without these actions the potential harm to native mussel and endemic aquatic species in inland lakes could be substantial. But this is just one of innumerable potential invaders, and the larger question asks how we stop an invasion before it starts.

Photo: Paul Brown

Ballast water aboard ships is one of the main vectors for introducing invasive species. When not hauling cargo, many ships must bring aboard water to increase the stability of the boat. When cargo is offloaded in one port, the ship brings on ballast water to replace the cargo. Then the ship takes that water and the organisms within to another port where it discharges the ballast as it loads new cargo. Duluth, Minnesota is a prominent area for ballast exchange.

Isle Royale collaborates with numerous entities in the region and around the country to help combat the spread of AIS from ballast. Thanks to Great Lakes Restoration Initiative funding, in May Isle Royale National Park completed the installation of a new ballast treatment system aboard their passenger vessel, the M/V Ranger III. The Ranger III carries passengers and cargo between Houghton, Michigan and Isle Royale National Park located on Lake Superior. The Ranger III crew minimizes the amount of ballast released, but water intake and discharges are required at times for safe ship operations. For that reason, ballast treatment is critical. Currently there are AIS found at the Island that are not found in Houghton and vice versa, so implementing a system to prevent transfers was critical.

Staff at Isle Royale have also helped coordinate the development of two new ballast treatment systems by the U.S. Geological Survey, the American Steamship Company and other industry and non-governmental partners. One system is intended for permanent installation on Great Lakes freight vessels unable to use commercially available treatment systems due to the unique operating conditions of the "lakers." The second system in development is intended for use in emergency situations such as grounding, high risk ballast or failure of installed ballast treatment equipment. The principal technological challenge for both treatment systems was mixing a large volume of water in tanks designed to prevent movement of water. Our team resolved this issue and is steadily moving toward formal adoption of both systems.

A great number of benefits to human use and enjoyment are at risk from AIS. In 2008, the U.S. Environmental Protection Agency reported that 58 new AIS had the potential to significantly disrupt the Great Lakes system. Estimates for AIS species damages in the Great Lakes alone have reached as high as $5.7 billion. With ballast water clearly one of the highest-risk vectors for AIS introduction, treatment and high standards should be a priority for anyone who cares about the health of our critically important Great Lakes ecosystems and resources.

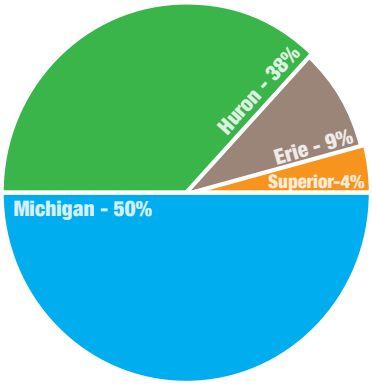
Photo: Michigan Sea Grant

Chapter IV: Great Lakes Fisheries

Todd Grischke, Todd Kalish and Phillip Schneeberger
Basin Coordinators for Lakes Huron, Michigan/Erie and Superior
Michigan Department of Natural Resources

This year in Michigan, Great Lakes anglers spent 4.3 million hours in pursuit of the "big one" or in many cases, dinner. Fishing is a huge contributor to quality of life in Michigan, for those who live here and for the state's many visitors. Keeping up with the fish can prove challenging, and keeping up with the lakes is a great place to start.

The successes seen in Great Lakes fisheries result largely from a combination of investments in critical habitat protection, quality hatchery products and efforts to rehabilitate native species. Strong wild reproduction of salmon, steelhead, walleye and perch has added to this success. On the other side of the coin, the lakes have also seen negative impacts from aquatic invasive species such as sea lamprey, zebra mussels, quagga mussels, alewives and round gobies.



2011 Michigan Angler Effort by Lake

For example, the Lake Huron food web has changed dramatically during the past decade, from the plankton at the base to the Chinook salmon at the top. The lake's most productive zones, historically offshore, have shifted toward nearshore areas as a result of these changes, with an effect on which fish species dominate the lake.

Alewives, once the main prey fish in Lake Huron, have fallen to an all-time low. Chinook salmon, reliant on alewives for food, have also declined. The DNR has implemented significant stocking reductions of Chinook salmon in Lakes Huron and Michigan to match the declining levels of productivity in the lakes, with natural reproduction the primary contributor to the fishery.

The decline of alewives also correlates with lakewide increases in wild reproduction of lake trout—a potential sign of a recovering population. Other Lake Huron fish like walleye, yellow perch and smallmouth bass have also shown signs of significant natural reproduction in the past decade.

Catch rates for Saginaw Bay walleye have skyrocketed since 2004, peaking in 2008 at a 30-year high. That year, catch rates for walleye were seven times those seen in the 1980s and 90s. Likewise, climbing catch rates in Lake Huron's steelhead fishery over the last several years show improvement and promise for the future.

In an effort to protect these fisheries, recent, focused control efforts have helped to keep sea lamprey populations below historic levels, but they are still above the target identified for effective control in Lake Michigan and Lake Huron. Non-native smelt have declined, but distribution of the invasive round goby continues to grow.

In Lake Superior, at least 39 invasive species have become established over the past four decades. In spite of these challenges, the lake boasts completely rehabilitated populations of lake trout, which reached perilous lows in the 1950s, 60s and 70s. Today the fish have achieved near-historic levels of abundance in most areas of the lake due to stocking, and are now self-sustaining.

Lake Erie presents a very different fishery than the upper Great Lakes, characterized by perch and walleye. Yellow perch populations have fluctuated, drastically falling and rising twice since the 1960s due to nutrient problems in the lake, the varying health of plant life called macrophytes, overexploitation and other issues. Interagency efforts to reduce exploitation and protect spawning perch have resulted in the rebuilding of stocks, steady harvest and several recent strong year-classes.

In 2005, Lake Erie's overall walleye population surged, becoming a "high quality" stock, indicating more than 40 million individuals, for the first time since 1993. Improved management and reproductive success, as well as a higher availability of food led to this increase. The population has fluctuated since 2005 but some postulate that the potential for trophy walleye in the lake has never been higher.

Michigan's world-class freshwater fishery depends on healthy lakes and careful understanding of these complex ecosystems. The state's $2 billion annual angling economy supports thousands of people and raises quality of life for residents and visitors alike. Great fishing is just one part of Pure Michigan, but it is an essential part.

Photo: Michigan Sea Grant

Chapter V: Coastal Wetlands

The land-water interface helps define Michigan's identity and creates a sense of place in the Great Lakes State unlike anywhere else.

Michigan's coast is characterized by unique ecology, culturally significant waterfronts, historical features and abundant recreational opportunities. Many of our natural riches lie within the wetland areas that line much of our coast, drowned river mouths and island gems.

The term "coastal wetland" refers to diverse landscapes—marshes, fens, bogs, freshwater estuaries, forested dune and swale complexes, lake plain prairies and more.

These areas provide habitat for hundreds of bird, fish and amphibian species. Fish use coastal wetlands at all stages of their life cycle. And as adults, more than two-thirds of lake fish species spawn here. Birds, reptiles and amphibians also live in coastal wetlands.

Coastal wetlands provide critical habitat for migration, feeding and nesting of waterfowl and shorebirds. These stopover sites during spring and fall migrations attract birders from across the continent to catch a glimpse of a rare species.

Unfortunately, development has resulted in wetland degradation, and about 50 percent of these critical areas have been lost to agriculture and industry in the last 150 years. In addition, sedimentation, contamination and invasive species often threaten these areas.

But with Great Lakes Restoration Initiative funding, the state is making significant progress in restoring large coastal wetland systems in areas like Saginaw Bay, Lake St. Clair, and Western Lake Erie. This has helped move forward projects to restore the hydrology of wetlands to accommodate re-established flora, educate the public on the benefits of wetlands, remove invasive *Phragmites*, enhance habitat for rare wildlife and more.

Further restoration in these areas also will provide improved hunting, fishing, canoeing, hiking, bird watching and other recreational opportunities for residents and visitors.

Many federal, state and local programs have gotten involved in protecting and restoring coastal wetlands, including the Coastal Zone Management Program, administered by the Michigan Office of the Great Lakes.

The CZMP provides funding and technical assistance to support on the ground restoration projects, feasibility studies for restoration and resource management, and outreach to improve public understanding of coastal habitats.

Partnership and collaborations have and will continue to be crucial to continued success in restoring and protecting these incredibly valuable and diverse areas.

Northeast Michigan Cooperative Weed Management Area: Building a Sustainable Invasive Species Program

Jennifer Muladore
Ecologist
Huron Pines

The northeast portion of the Lower Peninsula faces different issues than counties to the south when it comes to fighting aquatic invasive species. Tourism, a major source of income to people on the Great Lakes coast and inland waterways, is also particularly vulnerable to AIS in this region of the state. At the same time, the area—particularly the coast—is home to many rare and endemic species of plants and animals found nowhere else in the world.

Even frequent visitors to the beaches of Northeast Michigan may not have heard of the Pitcher's thistle (an endangered native wildflower) or invasive *Phragmites* (a tall grass). But the invasive form of the grass is quickly spreading across the thistle's native beach habitat. In the process, high-density Phragmites stands have obscured views and blocked waterfront access.

Because the shoreline ecosystems in Northeast Michigan are relatively undeveloped and intact, protecting these ecosystems is especially important. Even though invasive plants are moving northward along shorelines and roadways, or southward from the Straits of Mackinac, they can be stopped–without costing large sums of restoration money.

Huron Pines, a nonprofit group working to conserve the forest, lakes and streams of Northeast Michigan, has spent the last four years spreading the word about invasive species to locals and visitors. The outreach has also laid the groundwork for a strong, locally-led effort that will continue, we hope, for years or decades to come.

Working with landowners, local governments, state and federal agencies, and other partners within the structure of the Cooperative Weed Management Area partnership, we set goals based on acres treated as well as the number of people reached. The collaborative efforts of all agencies, nonprofit groups, and individuals together are part of what make the Northeast Michigan CWMA so strong.

Through a series of grants from the Coastal Zone Management program, Huron Pines has been able to help people better appreciate the good, wild things about northern beaches while enabling them to watch for and prevent invasive species from further establishing themselves in the area.

In 2011 and 2012, Huron Pines staff gave over 30 presentations to landowner groups, service organizations, garden clubs and volunteers. We also developed an information packet about the special natural features of Northeast Michigan's coastline and the invasive species that threaten them, providing them to 10,000 landowners and visitors. Through this effort and our volunteer and education events, we have connected with residents who assist with reporting the locations of invasive species and landowners willing to organize AIS treatments.

The work of the volunteers has not only expanded our treatment area, it has enabled our "Invasive Species SWAT Team" to focus on high-priority hotspots, protecting rare and endangered species and heavily infested areas at the same time. In 2012, our SWAT Team treated nearly 70 acres of *Phragmites* in coastal counties—but this doesn't tell the whole story. The number of acres treated has gone down since 2011, along with the density of the remaining stands, and the number of people grouping together to kill invasive species in cooperation with each other has greatly increased. There is still a lot of work to be done, but success is in sight.


Photo: Jennifer Muladore

Supporting partners:
U.S. Fish and Wildlife Service
U.S. Forest Service
Natural Resources Conservation Service
Michigan Department of Environmental Quality
National Oceanic and Atmospheric Administration
National Fish and Wildlife Foundation
The Carls Foundation
DTE Energy Foundation
Michigan Natural Features Inventory
Paul H. Young Chapter of Trout Unlimited
Au Sable River Property Owners Association
Individual donors

Huron Pines welcomes volunteers throughout the spring, summer, and fall to assist with reporting and treating AIS—visit www.huronpines.org to learn more.

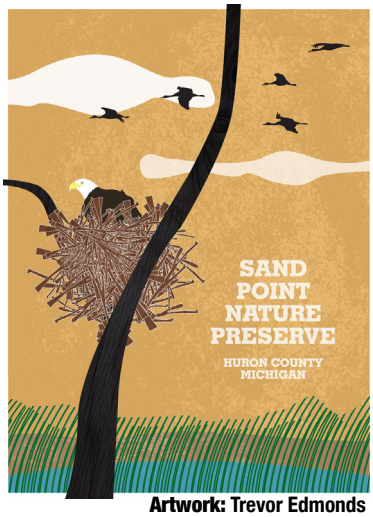
For more information about the Northeast Michigan CWMA or the Huron Pines invasive species program, contact Ecologist Jennifer Muladore at 989-448-2293 ext. 31 or Jennifer@huronpines.org.

Restoring the Wetlands of Saginaw Bay

Charles Bauer
Senior Environmental Quality Analyst
Michigan Department of Environmental Quality

Saginaw Bay contains one of the largest areas of freshwater marsh in the world. In addition to its extensive coastal wetlands, the watershed boasts the Shiawassee National Wildlife Refuge, more than 9,600 acres of marsh, bottomland hardwood forest and grasslands. The Shiawassee State Game Area contains another 9,758 acres of natural area. A magnet to birders, fishermen, hunters and tourists, the bay's wetland resources generate an estimated $15.9 million per year in recreational revenue.

Unfortunately, the benefits provided by the bay's wetland resources were not always so well appreciated. In the past, many of the Saginaw Bay's coastal wetlands were converted to farmland or other uses, causing significant loss of natural habitat. This historic wetland loss in part led to the area's designation as a Great Lakes Area of Concern more than 30 years ago. But recent efforts to restore and protect wetlands in the Saginaw Bay watershed have come a long way toward addressing these historic wetland losses and ensuring that this area remains a jewel of the Great Lakes.



Artwork: Trevor Edmonds

Federal, state, local and non-governmental partnerships have proven critical to restoration efforts. The state provides a base of protection for coastal habitat around the bay through the Michigan Department of Environmental Quality's Environmental Areas program, which requires landowners to carefully manage environmentally sensitive places. Landowners in these approximately 120 areas must obtain DEQ approval for potentially harmful activities such as altering the soil or vegetation, harvesting timber within colonial bird nesting areas or building permanent structures.

The federal government, through the U.S. Fish and Wildlife Service, manages the Shiawassee National Wildlife Refuge and is currently working with Ducks Unlimited to restore 700 acres of emergent marsh and enhance 240 acres of existing wetland dominated by invasive species. This project includes fish passage to all 940 acres of emergent wetlands. The project area is surrounded on three sides by the refuge's new auto tour route and will create outdoor recreation opportunities for the public.

Land conservancies in the watershed have been key partners to the protection and restoration of the bay's wetland resources. The Saginaw Basin Land Conservancy recently added 44.4 acres of land to its existing Sand Point Nature Preserve in Huron County. SBLC now oversees seven preserves adjacent to the Saginaw Bay shoreline totaling approximately 563 acres. These preserves are open to the public.

Federal, state, local, and non-governmental partners all have recognized and wisely prioritized programs to control the invasive reed, *Phragmites*, which often displaces native species of plants and animals. This has proven critical to coastal wetland rehabilitation in Saginaw Bay. The FWS and Bay County have collaborated to address several miles of shoreline afflicted with *Phragmites*. The FWS also has committed funding to Arenac and Huron Counties for similar control efforts. In another project, SBLC is working to restore approximately


Photo: Michigan Sea Grant

200 acres of coastal wetland areas to lake plain prairie habitat by removing invasive *Phragmites* and boosting the native seed bank.

Overall, wetland restoration and protection in the Saginaw Bay has been very successful. Based on a June 2012 Ducks Unlimited report, updated analysis showed 60 percent of the existing wetlands in the Saginaw Bay Coastal Plain are protected. The vast majority of areas considered high priority are protected, but 4,529 of the most important acres remain unguarded. If those also were conserved, the overall rate of protection in the Saginaw Bay Coastal Plain would increase to 72 percent. Certainly, more work can be done to ensure long-lasting protections, especially in high-priority areas.

Michiganders and state visitors treasure the ecological wealth of the Saginaw Bay's beautiful wetlands. Even if it goes uncelebrated, these wetlands' contribution to water quality affects scores of people around the bay and beyond. The services these areas provide as well as their immutable contribution to the local identity and culture have inspired careful maintenance and diligent protection. We all are beneficiaries of these worthy projects.

For the Saginaw Basin Field Guide, visit www.sblc-mi.org/guide.html

Photo: Michigan Sea Grant

Chapter VI: Localized Restoration

As a world-class manufacturing center, Michigan changed history. Our state became synonymous with the prosperity brought by booming industry. Michigan used her own ore and workforce to produce the products of the day. But we now know that for all of its positives, many of the waste handling practices common in this era contaminated some of our most prized natural waterways.

After the signing of the Great Lakes Water Quality Agreement between the U.S. and Canada and the passage of the Clean Water Act, both in 1972, remedying contemporary sources of pollution was the necessary first action. We have dramatically cleaned up our waste streams and the places where they discharged.

We now are left with the task of repairing the damage inflicted by years of historical dumping, and we are making remarkable progress in restoring healthy ecosystems in the Great Lakes.

Progress shows up most prominently in localized restoration efforts, particularly in the Great Lakes Areas of Concern. The GLWQA has driven restoration efforts, providing a framework of beneficial uses of water, such as safe beaches for swimming, fishing and clean drinking water, and the underlying rationale for restoring those where impaired.

Over the last 40 years, many uses have been restored. The following articles tell that story through many stories of individuals at the local level. Piece by piece, these will lead to the ultimate goal of the near future—beginning to delist some of Michigan's 14 AOCs. Decades in the making, declaring for the first time that a Michigan AOC is no longer impaired will be historic. The federal Great Lakes Restoration Initiative has provided funding for many projects, and serves as a rising tide lifting all boats.

We can once again use and enjoy places like the south shore of Muskegon Lake and White Lake, both AOCs that have come a long way. Many more places, such as the Manistique River, are not far behind.

In other areas, we no longer consider just site-specific remedial actions and neither do we anticipate stopping at restoration. We will look beyond revitalization to a renaissance for the Great Lakes.

A major part of this revitalization involves helping places with economies affected by environmental degradation to recover. In this chapter, economist Dr. Paul Isley details the ways in which restoration projects have already boosted the economy around Muskegon Lake even though it remains an AOC.

As these areas look to revitalization, Great Lakes health is on its way back. The collaborations that have emerged from this process involve a remarkable group eager to maintain course with sights set on restoring every last beneficial use hindering Michigan's AOCs.

There is still a long way to go, but we are making strides and a Great Lakes renaissance, with resilient natural ecosystems and revitalized coastal communities, is on the horizon.

Revitalizing the River Raisin Area of Concern

Barry LaRoy
Commissioner
Monroe Commission on Environment & Water Quality

The River Raisin in Southeast Michigan provided the backdrop for some of the most pivotal points in Michigan history. The area hosted a battle in the War of 1812 which so inspired American revolutionaries that "Remember the River Raisin" was their rallying cry as they drove the British from Michigan forever.

Later, Ford Motor Company built on the banks of the river along with other manufacturers during a different revolution—the Industrial Revolution. Today, however, the River Raisin is part of a restoration revolution, which looks to heal this historic site for the birds, fish and people who find themselves drawn to its running waters.

In 1987, the River Raisin was designated a Great Lakes Area of Concern, with polychlorinated biphenyl-contaminated sediment the primary issue. But the problem proved deceivingly complex. This single chemical led to three of the site's nine beneficial use impairments:

- Restrictions on fish and wildlife consumption
- Bird or animal deformities or reproductive problems
- Restrictions on dredging activities

Ten years after the AOC designation, Ford Motor Company removed 20,000 cubic yards of highly PCB-contaminated sediment from the area under orders from the U.S. Environmental Protection Agency.

From 1998-2002, EPA and the Michigan Department of Environmental Quality monitored the AOC, finding high levels of PCB still remaining.

Further removal came with a Great Lakes Legacy Act funding agreement in April, 2012. Its EPA Contaminated Sediment Project includes the utilization of a "confined disposal facility" at Sterling State Park for the materials that will be removed from the AOC. The site also will maintain capacity to store sediment removed in the future for navigation channel maintenance.

The river's dams have restricted fish movements for many years. A new River Raisin fish passage project aims to reconnect Lake Erie to the lower 23 miles of the river, allowing access not seen in decades for fish, canoes and kayaks. The project will restore and improve habitat that will support beneficial uses by fish and wildlife.

The first phase reopens 3.5 miles of the river by removing two low-head dams and installing rock arch rapids at two locations in Monroe. Phase II will reconnect 19.5 river miles by installing two rock arch rapids, constructing a small channel adjacent to Waterloo Dam and cleaning out Grape Mill Race.

Sterling Island, a man-made island within the AOC, has experienced significant erosion, impairing spawning, nursery and refuge habitat for fish and aquatic organisms. A corrective project will address the area's "Loss of Fish and Wildlife Habitat" BUI by constructing a rock deflector and longitudinal stone toe to protect the existing bank against river flows, ice floes and wave action from Lake Erie. Further, the effort will improve the grade and install timber steps to prevent erosion caused by pedestrian foot traffic. Under the water's surface, a rock-substrate spawning area and basking zone for waterfowl and turtles will provide additional wildlife habitat.


Photo: Environmental Consulting Technology

By the end of the year, a project by the Michigan Department of Natural Resources will recreate approximately 18 acres of Great Lakes marsh and 32 acres of lakeplain prairie. A second project will repair dikes and install water control for 310 acres of marsh and control invasive *Phragmites* in approximately 1,100 acres.

All told, these projects drew nearly $7 million in funding from the Great Lakes Restoration Initiative and more than $17.3 million from EPA and DEQ. This investment provides extraordinary benefits to the River Raisin's plant and animal inhabitants, as well as its human neighbors and visitors. Our goal is that, with the crescendo of this restoration revolution, the area will shed its AOC designation, providing a new reason for people everywhere to "remember the River Raisin."

Restoring Beneficial Uses in the Kalamazoo River, Muskegon Lake and White Lake

John Riley and Stephanie Swart
Area of Concern Coordinators
Michigan Office of the Great Lakes


Photo: John Riley

Jump-Starting the Healing Process

The Great Lakes Area of Concern program in 2010 entered a new era of on-the-ground action, fueled by an infusion of funding in the form of the Great Lakes Restoration Initiative. This program provides the necessary capital to bring some of the Great Lakes' most distressed areas back from the brink.

Before GLRI funding became available in 2010, only seven Beneficial Use Impairments were removed from Michigan's 14 AOCs. But with newfound federal resources, Michigan was able to more than double that count—to 15 total – in 2011 alone. More hard work and collaboration this year further increased momentum, with nine BUIs removed or in the process.

Degradation of Aesthetics Focus

The Michigan Office of the Great Lakes, with assistance from the Michigan Department of Environmental Quality's Water Resources Division, designed and administered a statewide assessment for the Degradation of Aesthetics BUI. Areas with this impairment have had issues with water surface oil sheens or scum, unnatural colors, turbidity or other visual problems.

The assessment showed no problems in repeated samplings of the River Raisin, the Kalamazoo River or the St. Clair River AOCs, and those BUIs were removed.

Progress in White Lake

Two BUIs were removed from the White Lake AOC in Muskegon County this year and a third is pending. Ongoing collaborative relationships with faculty and staff at the Grand Valley State University Annis Water Resources Institute, along with efforts by the Muskegon Conservation District, have proven instrumental to the area's progress. Researchers undertook studies to evaluate nutrient levels and assess the communities of bottom-dwelling organisms that make up the base of the food web.

Those studies show that while phosphorous levels remain slightly elevated, the lake is no longer considered eutrophic. And lake sediments—once highly contaminated—now support a diverse and healthy biological system of invertebrates to anchor the food web. As a result, both the Eutrophication or Undesirable Algae BUI and the Degradation of Benthos BUI were removed from the White Lake AOC.

Following a comparative analysis of edible portions of fish tissue from 2006 and 2011 in White and Muskegon Lakes, the state of Michigan will recommend that the U.S. Environmental Protection Agency remove the Restrictions on Fish and Wildlife Consumption BUI from both. It is important to note that although the BUI will be removed in the short term, fish consumption advisories remain in place for these and other lakes in the state. For specific information, consult www.michigan.gov/eatsafefish.

Muskegon Lake Partnerships

The city of Muskegon was once among the largest cities on the east coast of Lake Michigan, thanks in part to thriving timber and fur businesses, as well as paper manufacturing, smelting, and oil and gas production.

While those activities brought a commercial boon, they also led to contaminated sediments, degraded habitat and the loss of many recreational uses in the region. In many areas, the waterfront serves as a gathering place, bolstering community. At Muskegon Lake, nine BUIs have stood in the way. But that number is shrinking, thanks to exceptional coordination and collaboration.

Through partnerships developed between residents and state, local and federal governments, three BUIs have been removed, or are in process. DEQ and EPA have taken out contaminated sediment at Ruddiman Creek and the Division Street Outfall.

Perhaps the most impressive example of teamwork came with a plan to address a long-contaminated property in northeast Muskegon. No combination of effort other than full participation from EPA, the U.S. Army Corps of Engineers, DEQ, city of North Muskegon, Muskegon Lake Watershed Partnership and state legislature could have resulted in success at this site. Using this vast pool of expertise, the group pulled together funding from extremely diverse sources to map the contamination on the property and develop a plan to address the problem.

Outcomes

Local citizens, government agencies, nonprofits and others all have contributed to unprecedented restoration efforts in Michigan's AOCs. Combined with essential funding from the GLRI, these stakeholders have in the past two years alone removed or laid the groundwork to remove 17 BUIs—a tremendous achievement.

As the AOC program has matured, the people behind it have refined their approach to restoration, apparent in the ever-accelerating pace of restored beneficial uses. Thanks to these efforts, Michigan will soon see its first AOC delistings and, we hope, a boost in quality of life.

Coastal Restoration Economics: Many Happy Returns

Dr. Paul Isley
Professor and Chair of Economics
Grand Valley State University

It may seem impossible, at first thought, to assign a value to a fishing trip, an afternoon at the beach or a shoreline walk. But it is indeed possible, and extremely important in helping to determine how to best use limited resources to restore coastal areas in need of improvement.

A variety of techniques can help to determine the value of a land or water use related to a coastal restoration. But the most common ways to measure that value involve rising property values near the restoration, increased recreation values, and the value of improved quality of life. A discussion of these techniques can be found at http://1.usa.gov/RROrqc.

A recent Muskegon Lake shoreline restoration provides a good example of each technique, used right here in Michigan: http://bit.ly/RROLoU.

In Muskegon, contractors removed fill, softened shoreline and restored natural vegetation. This created a better shore-to-land interface, improving the biological system supporting aquatic life, which is particularly beneficial to recreational fishing. Over time, it will also improve water quality by influencing runoff, which is important to anyone participating in recreation in or around the water.

Surveys showed that the healthier biological system at Muskegon Lake improved the recreation experience for boaters and fishermen, as well as for people biking and hiking around the shoreline. A dollar value for the improved recreational experience can be calculated by observing whether more people use the area and if they are willing to spend more to do so.

In this case, the $10 million spent on the restoration resulted in an estimated 65,000 additional visits to the area, generating $1 million a year in extra spending. In addition, the visitors had an improved recreational experience, which can attract travelers from farther away.

Improving the aesthetics of an area by softening the shoreline can have a profound effect on housing prices. Homeowners in the area prefer a natural waterfront over the aging, hardened shoreline, resulting in higher housing prices near natural coastline. The increased value can be estimated by calculating how the value of a house changes with respect to distance from the restoration. An average house within 800 meters of the waterfront would increase in value by more than $3,500 in 2011. When aggregated across the affected area, property values increase by nearly $12 million. This not only makes current homeowners wealthier, but it also has the potential to add an additional $600,000 in property tax revenue.

Such a large percentage of the population lives or recreates in Michigan's coastal regions that improved coastal zones have the potential to be game changing. The increase in tourism will be one of the most visible components, but improved property values and higher values of recreation for local residents will improve the quality of life for Michiganders.

While impossible to measure, this value will show up economically with a rise in happy workers with ample housing assets. This kind of person is more likely to decide that Michigan is a great place to work, live and play – and will be more likely to stick around for the long haul.

Photo: Kathy Evans

Restoring the Deer Lake Area of Concern

Stephanie Swart
Area of Concern Coordinator
Michigan Office of the Great Lakes

Deer Lake, Carp Creek and the Carp River lie tucked away in the Upper Peninsula just west of Marquette. Judging by appearance alone, one might never suspect that this, one of the most productive lakes in the U.P., is also a Great Lakes Area of Concern. Mercury contamination, algae blooms and other issues in the lake have contributed to this designation.


Photo: Stephanie Swart

In 1981, the Michigan Department of Community Health issued a "do not eat" advisory for all fish species in the creek, river and lake. Mercury from historic mining in the area had accumulated in the fish, rendering them inedible. The lake's eagles suffered from reproductive difficulties and the lake was prone to algal blooms.

These were tough problems, but the local public advisory council, Michigan Department of Environmental Quality, the city of Ishpeming and the mining company Cliffs Natural Resources met the challenge head on. Ishpeming upgraded its wastewater treatment plant, which ended untreated and partially treated wastewater discharges to the creek, thereby reducing the algae blooms and phosphorous. By 2000, small decreases in mercury were also seen in some species of fish, which advanced the AOC toward removing its fish consumption beneficial use impairment.


Photo: Jered Ottenwess

Studies by the U.S. Fish and Wildlife Service showed a rebound in the eagle population, with the birds successfully reproducing on the shores of Deer Lake for the past 15 years.

The eagles' reproductive success and the wastewater treatment upgrades led to the removal of two BUIs, a benchmark on the road to removing the area's AOC designation. But mercury levels were still high, and Deer Lake needed more help.

Cliffs Natural Resources worked with the DEQ to minimize the disturbance of sediments in the lake, preventing a process called methylation, which makes mercury more harmful to fish and the environment. Recently, the fish of Deer Lake and the Carp River have shown a reduction in mercury levels.

Despite these improvements, Deer Lake fish still contained enough mercury to require the catch and release designation for the lake. A study of mercury sources showed that Partridge Creek, a tributary to Carp Creek, could be a contributor. Originally part of the storm water system in Ishpeming, Partridge Creek was diverted into a mine in 1973 to combat flooding issues associated with the growing community. A 2004 DEQ study indicated that the creek was indeed a major source of mercury for Deer Lake.

Ishpeming has worked diligently with the DEQ and EPA to eliminate this, the last controllable source of mercury to Deer Lake and the Carp River. The crucial part for the city was cost, and during tough economic times in 2010 it allocated $700,000 to match $2 million in Great Lakes Restoration Initiative funding. Partridge Creek will be diverted from the mine shafts in two phases, with each phase creating naturalized stream channels while restoring and upgrading the city's storm water infrastructure.

Phase I is substantially complete, and Phase II will begin in the spring of 2013. The accomplishments in Partridge Creek will provide the city with restored areas for recreational use and allow DEQ and EPA to reach restoration goals for the Deer Lake AOC that once seemed impossible.

When the Partridge Creek diversion project is complete, Deer Lake and the Carp River will look the same as they do now—cold waters teeming with fish. The difference may not be outwardly visible, but the AOC is now on track to be among the first in Michigan to shed the designation, thanks to the perseverance of a dedicated few.

Bringing Back the Fish: Michigan Sea Grant and Partners Oversee Successful Habitat Reconstruction

Stephanie Ariganello
Communications Coordinator
Michigan Sea Grant, University of Michigan

The long, dark shapes looming on the screen took a moment to come into focus. As they did, the camera captured lake sturgeons performing what they'd done for eons—finding a suitable place to spawn. However, the fish represented more than just spawning to those on the other end of the camera—they symbolized a huge restoration success.

These sturgeons congregated on rock reefs installed as part of the St. Clair River Middle Channel restoration project led by


DNR Photo: David Kenyon

Michigan Sea Grant. The project focused on restoring fish spawning habitat in order to recruit several endangered or threatened fish species, including lake sturgeon, mooneye, northern madtom catfish and the river redhorse sucker. Valuable commercial and sport fish such as walleye and lake whitefish also are expected to use the reefs for spawning.

"It is science in action," said Jennifer Read, assistant director of Michigan Sea Grant and project lead. "This is the kind of research project where we're performing research not just to learn new things, but to apply what we've discovered. And with this project, we've been rewarded with early success."

Nine rock reefs were installed in the channel as part of this project. In addition to enhancing the reproduction of native fish, the goals were to:

- Construct one acre of fish spawning reefs connected to 14 square miles of nursery area in the St. Clair Delta.
- Restore fish habitat and help delist the St. Clair Area of Concern.
- Improve understanding of fish communities and habitat restoration

Following the initial video evidence, researchers surveyed the area and collected eggs. Lake sturgeon had successfully deposited and fertilized their eggs on the reefs, producing viable larvae.

The Big Picture

To compensate for historical habitat loss, Michigan Sea Grant and project partners completed two previous reef projects in the Detroit River. The location and design of the Middle Channel reefs were chosen based on lessons learned during those projects.

"That's what is really unique about the Middle Channel project," said Read. "It reflects over 10 years of work performed by a multi-agency science team tackling increasingly complex questions over a large geographical area. It's a successful, system-wide approach to restoration."

Because of the Huron-Erie Corridor's location in the heart of the Great Lakes, the restoration has potential to benefit waters upstream and downstream. The restoration efforts could also provide cultural and economic benefit, bolstering commercial and sport fishing and contributing to a higher quality of life in an area currently listed as an Area of Concern under the Great Lakes Water Quality Agreement.

Post-construction assessments are being carried out to ensure the new reefs are being used by a variety of fish species. Researchers will search for evidence of walleye, lake whitefish, perch, bass and suckers using the reefs.

Connecting Partners

The restoration effort has been a long-term collaboration among agencies, scientists and resource managers.

Two more spawning reef projects are planned for the St. Clair River and another reef in the Detroit River at Fort Wayne in 2013 as part of the Great Lakes Restoration Initiative.

Project partners

U.S. Geological Survey, Michigan Department of Natural Resources, U.S. Fish & Wildlife Service, the University of Michigan, NOAA, SmithGroup JJR and Michigan Wildlife Conservancy

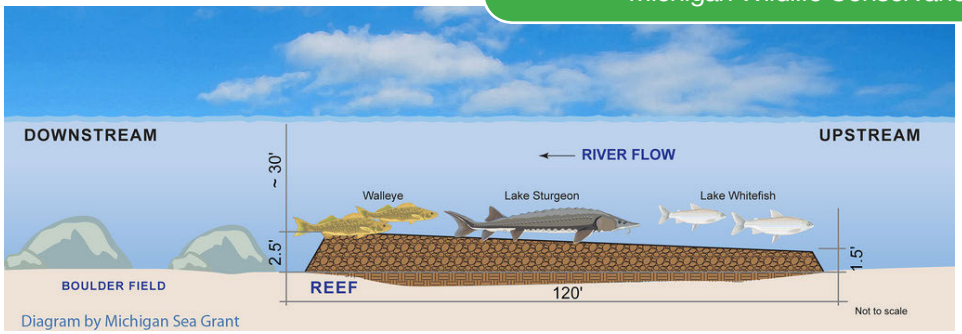


Diagram by Michigan Sea Grant

Lakewide Conservation: A Collaborative Approach

Mary Khoury
Aquatic Ecologist/Conservation Planner
The Nature Conservancy


NRCS Photo: John Whitney

The Great Lakes system is vast and varied. Just gazing at the distant horizon of one of the lakes can overwhelm a person. Restoration work can be even more daunting, especially if one tries to take it on alone.

Lakewide strategies have benefited from collaboration across political boundaries, relying instead on "nature's border" to shape our conservation approaches.

Lake Michigan and Lake Erie will soon join Lake Ontario and Lake Huron in having strategic plans to protect and conserve their native biodiversity. Funded through the U.S. Environmental Protection Agency and Environment Canada, these multi-agency planning efforts have assessed the lakes' natural systems, defined visions for biodiversity conservation and developed shared strategies to protect and restore the lakes. The plans also describe how these strategies can benefit people and promote coordinated conservation action. To round out the five Great Lakes, a similar process called a biodiversity assessment has begun in the Lake Superior basin, and will advise conservation efforts there.

The Nature Conservancy and Nature Conservancy of Canada completed the first of the strategic plans in 2008 for Lake Ontario, which has served as a model for developing lakewide biodiversity strategies and implementation. In 2009, the Lake Ontario Lakewide Management Plan Management Committee adopted these strategies into its LaMP document. In 2010, a core team of the Conservancy, NCC, Environment Canada, Michigan Natural Features Inventory and Michigan Sea Grant completed a biodiversity strategy for Lake Huron. Today, these strategies are being forwarded through the Lake Huron Bi-National Partnership. The Lake Erie and Lake Michigan Biodiversity Conservation Strategies will be released at the end of 2012. These plans were led by the Conservancy and NCC, as well as the Michigan Natural Features Inventory.

Common to each plan is a focus on the biodiversity of the lakes themselves as well as the immediate coastal area, while considering the influence of the whole lake watershed on this focal biodiversity. The biodiversity targets include the open water benthic and pelagic ecosystem, nearshore zone, native migratory fish, coastal wetlands, islands, aerial migrants, and coastal terrestrial systems. Strategies are specific to each Great Lake, so they vary by plan but all will consider certain pervasive threats. These include issues like agricultural and urban pollution, invasive species, incompatible coastal development, improving habitat connectivity impaired by dams and other barriers, and offshore fisheries restoration.

Conservation actions to implement these strategies are underway. For example, the Conservancy's Western Lake Erie Coastal Project seeks to create a network of functional coastal habitats, with emphasis on coastal wetlands. The Conservancy is also working to identify watershed-based priorities to help conserve migratory river-spawning fishes in Michigan's Lake Huron Basin.

In Western Lake Erie, the long-term goal is to rehabilitate coastal wetlands and related uplands at the ecosystem scale. We also are integrating ecosystem services and compatible stakeholder objectives into conservation strategies. Partners include the Ottawa National Wildlife Refuge, Detroit River International Wildlife Refuge, Erie State Game Area and Detroit Edison.

The Lake Huron Biodiversity Conservation Strategy identified the need for better information on key areas for migratory fish from Lake Huron into its tributaries. The Nature Conservancy, with funding from the Michigan Coastal Zone Management Program, identified 28 native river-spawning fishes, assembled historic and recent data, and synthesized this information to identify watersheds of importance to individual species and all 28 species overall. This report is available online at www.michigan.gov/coastalmanagement.

This year's revised Great Lakes Water Quality Agreement calls for the development of "lakewide habitat and species and restoration conservation strategies." Thanks to the hard work of a huge diversity of partners four of these are already in place, and we are ready to hit the ground running to continue implementation. For this to succeed, we need to continue to manage the lakes holistically, and further break down barriers between stakeholders in the basins.

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DNR Photo: David Kenyon

Shared Governance: The Key to Our Great Lakes Future

This year, we took a new approach to the State of the Great Lakes Report. Rather than providing a tabulation of information and trends on the lakes, this report has focused on cooperation and collaboration—people engaged in important work—tangible improvements through restoration projects, partnerships, in pursuit of a collective vision for the future of Great Lakes management. It focused on our stories. It focused on our shared responsibility.

The earliest people that came to the basin found the forests and the lakes brimming with hope and promise—and they stayed. Those that came later by ship, rail and on foot also found remarkable abundance on land and in the water, and used that capacity to fuel great commerce, progress and stunning wealth. Some, however, regarded the lakes with less care and respect than they deserved—and we are still working to undo that damage. This will take time, but the lakes can rebound with careful attention and shared diligence.

The hard data reflecting nearly 50 different aspects of the health of the Great Lakes is readily available through the binational work of the State of the Lakes Ecosystem Conference (http://www.epa.gov/solec). In general, some of the data will show hope—remarkable improvements in the health of the Great Lakes. Other data however, especially those that relate to invasive species and their effects on the health of the aquatic food web, show considerable signs of stress on the lakes. To those stressors and threats, we need solutions, and we need them fast. Our trends overall are both positive and hopeful, yet others require careful tending.

We will again see people from around the country and the world flock to the Great Lakes region. Part of their incentive will come from the lakes' beauty, and some from its capacity to support life and in turn its ability to fuel a powerful and healthy economy. Opportunity and wealth flows from a richness of human and natural resources. For future residents and those already here, we must be ready so we do not repeat the errors of the past. We can support a thriving economy but we must do it within nature's limitations.

Michigan's successful vision for shared governance will undoubtedly play a role in people's desire to return to the Great Lakes. Government cannot and should not be called on to do everything for all. It plays an important role, but individuals and communities must continue to share in the work of our state, in the care for the lakes, in the restoration of our places, in the preservation of important and rare places and in carrying out the new vision for our state and region. Our strength lies in us all working together towards fundamental ecological health, social capacity and citizenship and economic vitality.

We see this effort in the work of tens of thousands of people across the state. Organizations cleaning beaches, testing water, fighting invasive species and giving freely of their time and money. Businesses voluntarily going beyond their compliance obligations and philanthropies providing support in the tens of millions of dollars for all types of efforts. We all do this work because we know it is necessary and important. This is the work of our people. It is our heritage.

Some see our Great Lakes region without indelible borders; without the political lines drawn on the map. They see it as an intact and connected system that flows from west to east, with a fluid blue artery running through our land. Yes, we are Michigan—Pure Michigan to be sure, but we are all also one with the lakes; one with the tribes; one with our Canadian neighbors and most importantly we are one with each other. This is our promise—we share this place, we share in its bounty and we share in its responsibility.

Department of
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